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SR N° 27940. 01

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USE OF LANDSAT DATA FOR NATURAL RESOURCES  
INVESTIGATION IN THE LOWER BASIN  
OF DANUBE AND DANUBE DELTA

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RESOURCES INVESTIGATION IN THE LOWER BASIN  
OF DANUBE AND DANUBE DELTA Progress Report,  
May - Dec. 1975 (College for Civil  
Engineering) 13 p HC \$3.50

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for period May-December 1975

Report Date: December 1975

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Sponsoring Agency:

ROMANIAN COMMISSION FOR SPACE ACTIVITIES  
NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY  
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12. Sponsoring Agency Name and Address  ROMANIAN COMMISSION FOR SPACE ACTIVITIES NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY Str.Roma 32, Sector 1, Bucharest Romania	13. Key Words (Selected by Principal Investigator)  - Multidisciplinary studies - Natural resources inventory - Wetland and coastal zones - Thematical maps - Phenology	
14. Supplementary Notes  FIRST LANDSAT DATA RECEIVED ON OCT.27 <sup>th</sup> 1975 (BEING PERIPHERIC-MARGINAL) AND ON DEC.6 <sup>th</sup> 1975 RESPECTIVELY		
15. Abstract  Due to the delay in the receipt of data, the program of the inves- tigation developments had to be revised.  Besides, meteorological conditions were unfavourable impeding the accomplishment of the concordance between airborne and space re- cordings during periods of utmost interest for investigation.  However, the recordings on bands 4 and 5 very clearly show the sedimentary discharge in sea water at the mouth of the Danube, while recordings on bands 6 and 7 show the successive stages of the evolution of the Danube Delta, clearly marking the separation of the fluvial delta from the marine delta.		

1 - OBJECTIVES OF THE PROJECT DADELTA (USE OF LANDSAT DATA FOR RESOURCES INVESTIGATION IN THE LOWER BASIN OF DANUBE AND DANUBE DELTA)

First of all, the objective of the investigation is the multidisciplinary study of land use and the natural resource inventory according to Landsat 2 type data with the aim of determining the utility of these data. At the same time the way of employing Landsat and airborne data, in sample areas for natural resources inventory is also to be studied. The study of areas so far unaffected by man's intervention as well as of areas where man has already intervened is stipulated.

The second aim is to form and organize staffs of specialists, who, as a result of instructing and exchanges of experience, through directly handling satellite and airborne recordings should be capable of improving earth's resources projects.

Performing specific technological works such as : preliminary processing, sampling, phenology, thematic maps etc and the surveying in wetland, delta and coastal zones, classification of vegetation types and their quantitative estimate, geological studies directed mainly towards ground water and identification of geothermal zones, will ensure a better knowledge and gaining of experience in handling the data complex flow processing, with defining the advantages and limitations of remote sensing.

2 - SUMMARY OF THE ACCOMPLISHMENTS DURING THE PERIOD MAY - DECEMBER, 1975

2.1. - Pre-flight investigations

An index map of our country has been drawn up, determining Landsat 2 cycles data for each zone ;

Existant documentary materials, mainly airphotos and thematic maps have been collected and classified in accordance with objectives and interests. Sampling areas as distribution and characteristics to be determined have been established, a number of field work being also performed such as : openings of profiles and pre-markings for aerial-photos on the 1:50,000 scale or even greater ; developing pre-marking satellite mirrors, stationary as well as on floats on water bodies ; experimental determinations on profiles with AGA thermovision with the "window" at 4,5 microns;

laboratory spectrophotometrical determinations for the 0.3-2.2 microns zone by means of the Beckman spectrophotometer, for the main delta phytoassociations ; determinations for suspensions in the coastal area, in some inland lakes and rivers ; establishing eutrophication in the coastal area ; airphotos on panchromatic and color film in the test site zones, summing up about 3,000 km of photos flight lines and respectively 2,000 aerial photos with sampling value ; determinations by means of radioactive isotopes in order to survey surface and ground water; probings on specially selected profiles, etc.

During the first stage of the development of investigations, the major interest was focussed on the Landsat cycles in June-July and respectively in September 1975.

Intense organizational activity has been carried on and agreements were concluded on scientific research with 14 institutions and enterprises.

Documentation, exchange of experience and visits have been accomplished; according to NASA model, instructions for investigation developments within the program (a volume of 190 pages) have been drafted as well as a guide for Erts-Landsat data utilization (200 pages) ; selective documentary note-books n<sup>o</sup>1 (184 pages), n<sup>o</sup>2 (394 pages), n<sup>o</sup>3 (402 pages) have been drawn up, containing reports, abstracts of papers, published articles or papers elaborated on the occasion of various specialized manifestations, symposia, conferences etc ; a centralized library with card index has been set up ; two conferecens on remote sensing themes were held ; the films "A Long View - Erts" - NASA and "The world of Invisible Color" - Bendix have been dubbed in Romanian ; discussions took place with visiting specialists and who delivered lectures here :M. Baumgardner, W. Norberg, W. Stoney, UNESCO delegates for delta areas.

Meteorological synoptic maps on the zone have been set up in order to determine the main characteristics during the Landsat cycles ; meteorological Nimbus satellite recordings were organized on the dates of the Landsat cycle which were enlarged up to the 1: 3,369,000 scale and investigations were initiated for their differential rectification in order to correlate them with the Landsat data on the same scale.

Some themes for the gradute students, as well as the themes of the candidates for a doctor's degree have been directed towards remote sensing applications.

## 2.2. - Preliminary data analysis

### 2.2.1.-Data receipt

Table n<sup>o</sup>1 shows the ID Numbers of the received data, date of recording, receipt date and short comments.

The multiplication of the recordings has been achieved in 15 copies each, on the 1:1,000,000 scale, distributed in 3 days to all those included in the remote sensing program.

A system of facilities has been worked out so that users should make some remarks and minimal specific processing.

After receipt of the first data set our Bulletin, the "Remote Sensing News" N<sup>o</sup>1 was issued in November 1975 (30 pages) ; after receiving the second recording set the "Remote Sensing News" N<sup>o</sup>2 (44 pages) came out in December 1975.

Table 1

ID Number	Quality MSS				Index	Date	Received	Comments
	4	5	6	7				
82183-08065	5	5	8	8	69/28	24.07.75	27.10.75	Good quality recordings; they do not cover the whole area; those apparently repetitive show heavy cloudiness in the areas of concern. Not all recordings mentioned in listing have been received: band 4 from 70/28, the small negatives of the 70/29 and 70/30 recordings on July 25, 1975.
82183-08071	5	5	8	8	69/29	24.07.75	27.10.75	
82256-08113	-	5	5	5	70/28	05.10.75	06.12.75	
82184-08125	5	5	8	8	70/29	25.07.75	27.10.75	
82184-08132	5	5	8	8	70/30	25.07.75	27.10.75	
82238-08122	5	5	5	8	70/30	17.09.75	06.12.75	
82239-08172	5	8	8	8	71/28	18.09.75	06.12.75	
82185-08184	5	8	8	8	71/29	26.07.75	06.12.75	
82239-08174	5	5	8	8	71/29	18.09.75	06.12.75	
82203-08183	2	2	8	8	71/30	13.08.75	27.10.75	
82239-08181	5	5	8	8	71/30	18.09.75	06.12.75	
82240-08230	5	5	8	8	72/28	19.09.75	06.12.75	
82205-08290	5	5	8	8	72/28	15.08.75	27.10.75	

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82183-08071	5	5	8	8	69/29	24.07.75	27.10.75	
82256-08113	-	5	5	5	70/28	05.10.75	06.12.75	
82184-08125	5	5	8	8	70/29	25.07.75	27.10.75	
82184-08132	5	5	8	8	70/30	25.07.75	27.10.75	
82238-08122	5	5	5	8	70/30	17.09.75	06.12.75	
82239-08172	5	8	8	8	71/28	18.09.75	06.12.75	
82185-08184	5	8	8	8	71/29	26.07.75	06.12.75	
82239-08174	5	5	8	8	71/29	18.09.75	06.12.75	
82203-08183	2	2	8	8	71/30	13.08.75	27.10.75	
82239-08181	5	5	8	8	71/30	18.09.75	06.12.75	
82240-08230	5	5	8	8	72/28	19.09.75	06.12.75	
82205-08290	5	5	8	8	72/28	15.08.75	27.10.75	

## 2.2.2. - "First glance" analysis

ID Number	Index	Date	Comments
82183-08071	69/29	24.07.75	MSS bands 4 and 5 show very clearly the sedimentary discharge in the sea through the 3 branches of the Danube more than 100 km away, in the period close to the disastrous floods in July 1975 ; It is of interest to monitor the above mentioned phenomenon on the adjacent recordings :69/28 on May 31, 69/29 on June 18, 68/29 on June 17, 68/30 on June 17 and respectively 69/30 on June 17 and respectively 69/30 on May 31 and June 18, retrospectively ordered but which we have not received so far.
82183-08065	69/28	24.07.75	
82184-08125	70/29	25.07.75	MSS bands 4 and 5 show the variation of the regime sedimentary discharge through the Danube branches to the sea at 24 hour interval ; by correlating the 69/29 recordings to the 69/28 ones mentioned above as well as to the six times repetitive 70/28 and respectively the six times repetitive 70/29 ones, all retrospectively ordered or via permanent order, but which we have not received so far. Bands 6 and 7 show the catastrophic floods at Galatzi and the Big Island of Brăila and mainly show the successive stages of sediments in the Danube Delta with clear marking of the separation between the fluvial delta and the marine delta; these recordings also point out the evolution of the phreatic at different levels of the Danube and inland waters.
82256-08113	70/28	05.10.75	
82184-08132	70/30	25.07.75	The 70/30 recordings make it possible to study the whole complex Black Sea coastal regime.
82238-08122	70/30	17.09.75	
82239-08184	71/29	18.09.75	Presents the Romanian Plain, one of the best recordings. The flood retirement may be seen as well as the autumnal state of the vegetation.
82185-08184	71/29	26.07.75	The recording from the same station on July 26 is of interest for the flood surveying but a too heavy cloudiness makes it only partially utilizable.
82239-08181	71/30	18.09.75	The recording on September 18 is very good; the repetitive one on August 13 shows a major deficiency on two bands and great cloudiness. They cover however only a small portion of the zone stipulated in the provisions. They are useful for complex general studies.
82203-08183	71/30	13.08.75	



ID Number	Index	Date	Comments
82239-08172	71/28	18. 09. 75	The recording on September 18, showing the curvature area of the Carpathians is very good. Though it covers a small portion of the area, it is of interest for the study of the dynamics of the phenomena.
82240-08230	72/28	19. 09. 75	Both recordings are mainly of a geological interest.
82205-08290	73/28	15. 08. 75	

### 2.2.3. - Plan for the next reporting period

The first stage interpretation is developing according to the data handling plan ; the initial general overlays are under fulfilment, correlated to the fieldwork carried out during the 1975 campaign. But due to great delays in the receipt of recordings, the Calendar with terms settled for the different stages of the investigation is to be revised.

## 3. MAJOR PROBLEMS ENCOUNTERED DURING THE COURSE OF INVESTIGATIONS

### 3.1. - On space recordings and other data

The space recordings we received, were sent much behind time.

The recordings of a retrospective order have not been received yet - mention is made of 22 sets of recordings ordered in the autumn 1975.

Recordings were not achieved on the dates on which major interest was focussed - in June and September - periods when most airborne recordings were also made as well as field determinations.

The zone has not been covered at least once entirely ; the repetitive coverage on the main zone has not been accomplished ; those made so far are periferic-marginal.

Many recordings mentioned in the sent NASA catalogues show that they don't fulfil the conditions of the agreement; yet, in order to supplement some investigation data and taking into account that in some cases the characteristics in the catalogues do not correspond to the real ones, we should like to have the 2,2 inch. negative size in all bands 5 and 7 placed at our disposal.

We have not received the Weekly Government Abstracts although requested as early as September 1975 ; the list of the principal investigators with the titles of their respective investigation themes has not been received either.

### 3.2. About the meteorological-hidrological conditions

Meteorological conditions were rather unfavourable during the period we refer to, under the estimated average resulted from the investigation of meteorological conditions in the past 30 years; this fact must be also correlated with the hour of the Landsat passover which is not favourable under our conditions being too early - at least for autumn, winter and spring.

The hydrological conditions - rainfalls and catastrophic floods intervened quite unexpectedly and in a surprising period - the second half of summer ; therefore we should have needed complete recordings on the whole Danube basin, before and after the development of the event.

The conditions of eutrophication in the Black Sea coastal area - probably correlated also with the conditions mentioned above - have been quite uncommon this year, also requiring recordings before and after the period of maximum occurrence of the phenomenon ; the same for eutrophication in the Lake Razelm area and the lagoon zone ; the same for limnological conditions on the whole.

## 4. SIGNIFICANT RESULTS

A most important result is that bands 4 and 5 very clearly show the sedimentary discharge into the sea and the spreading regime in the sea at the mouths of the Danube and out at sea at great distances - over 100 km.

Another particularly significant results is shown by bands 6 and 7, presenting the successive stages of sediments in the Danube Delta, with the clear marking of the separation between the fluvial and marine delta.

The survey of floods and of some of their effects may also be studied on all of the bands in the complex area of the Danube Delta and in the lower basin of the Danube.

## 5. CONCLUSIONS, PROPOSALS

The remote sensing program also arouses in our country a particular interest of a large group of specialists in various domains.

In spite of the difficulties caused by the belated receipt of data and by the uncommon meteorological-hydrological conditions, we may state that at present we have adequate conditions for the normal development of investigations counting

on attaining the proposed objectives and possibly their extension for specific intervened conditions.

To improve the system of data we possess and of those we are to receive, we propose :

- a) WGA should be placed at our disposal ;
- b) The possibility should be studied of our getting copies from the recordings in the area - bands 5 and 7, 2,2 inch negative in the period August, 1972 - November 30, 1976, even if they surpass the provision conditions (under agreement), with the specification that the price ceiling settled by provisions should not be topped.

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PRODUCT ID (INCLUDE LAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
	Clouds	Flood		
82184 - 08125 M	v	v		Agriculture, coastal zone, delta regime
82184 - 08125 4	v	v		Sediments, coastal
82184 - 08125 5	v	v		currents, alluvia
82184 - 08125 6	v	v		Vegetation, agriculture, irrigation
82184 - 08125 7	v	v		Hydrography
82184 - 08132 M	v			Hydrography, liniaments
82184 - 08132 4	v			Sea, coastal regime, agriculture, geology
82184 - 08132 5	v			Sediments, alluvia, coastal currents
82184 - 08132 6	v			Agriculture, vegetation
82184 - 08132 7	v			Liniaments
82238 - 08122 M	v			Geology, faults
82238 - 08122 4	v			Sea, coastal regime, geology
82238 - 08122 5	v			Sediments, alluvia, coastal currents
82238 - 08122 6	v			Vegetation, agriculture
82238 - 08122 7	v			Liniaments, hydrology
82256 - 08113 M	v			Geology
82256 - 08113 5	v			Vegetation, agriculture, delta regime
82256 - 08113 6	v			Agriculture, vegetation
82256 - 08113 7	v			Hydrology
				Water bodies, coastal areas

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
	Clouds	Flood		
82185 - 08184 11	v	v		agriculture, excess
82185 - 08184 4	v	v		humidity
82185 - 08184 5	v	v		Cross, surface phreatic
82185 - 08184 6	v	v		Vegetation, crops
82185 - 08184 7				hydrology, water bodies
				hydrology, faults, geo-
82239 - 08184 11				logy
82239 - 08174 4				Agriculture, crops, erosion
82239 - 08174 5				linia, vegetation
82239 - 08174 6				Vegetation, crops, air-
82239 - 08174 7				field, forest
				Water, bodies, hydrology,
				faults
				hydrology, geology
82239 - 08172 11				Agriculture, forest
82239 - 08172 4				Crops, forest, erosion
82239 - 08172 5				Forest, morphology
82239 - 08172 6				rivers
82239 - 08172 7				reservoirs, dams
				Faults, geology, linia-
				roads
82203 - 08183 11	v			Agriculture, forest
82203 - 08183 4	v			Crops, forest
82203 - 08183 5	v			Vegetation, urban area
82203 - 08183 6	v			Water bodies, linia-
82203 - 08183 7	v			roads
				Geology
82239 - 08181 11				Agriculture, forest,
82239 - 08181 4				geology
82239 - 08181 5				Vegetation, forest
82239 - 08181 6				Vegetation, erosion
82239 - 08181 7				urban area
				Water bodies
				linia, geology

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
	Clouds			
82240 - 08230 M	v			Agriculture, forest, hydrology, geology
82240 - 08230 4	v			Vegetation, erosions
82240 - 08230 5	v			Forest
82240 - 08230 6	v			Liniaments, faults
82240 - 08230 7	v			Geology
82205 - 08290 M	v			Mountains, urban area
82205 - 08290 4	v			Vegetation, forest, agriculture, pasture
82205 - 08290 5	v			Forest, morphology rivers
82205 - 08290 6	v			Liniaments, urban areas, industrial areas
82205 - 08290 7	v			Liniaments, reservoirs dams, geology

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